CLAIMS

I/WE CLAIM:

1. A very high repetition rate gas discharge laser system in a MOPA configuration comprising:

a master oscillator gas discharge layer system producing a beam of oscillator laser output light pulses at a very high pulse repetition rate;

at least two power amplification gas discharge laser systems receiving laser output light pulses from the master oscillator gas discharge laser system and each of the at least two power amplification gas discharge laser systems amplifying some of the received laser output light pulses at a pulse repetition that is a fraction of the very high pulse repetition rate equal to one over the number of the at least two power amplification gas discharge laser systems to form an amplified output laser light pulse beam at the very high pulse repetition rate.

2. The apparatus of claim 1 further comprising:

the at least two power amplification gas discharge laser systems comprises two power amplification gas discharge laser systems.

3. The apparatus of claim 1 further comprising:

the at least two power amplification gas discharge lasers systems are positioned in series with respect to the oscillator laser output light pulse beam.

4. The apparatus of claim 2 further comprising:

the at least two power amplification gas discharge lasers systems are positioned in series with respect to the oscillator laser output light pulse beam.

5. The apparatus of claim 3 further comprising:

the master oscillator gas discharge laser system fires at a pulse repetition rate of $x \geq 4000$ Hz;

each power amplification gas discharge laser fires and ½ x.

6. The apparatus of claim 4 further comprising:

the master oscillator gas discharge laser system fires at a pulse repetition rate of $x \geq 4000$ Hz;

each power amplification gas discharge laser fires and ½ x.

7. The apparatus of claim 3 further comprising:

the master oscillator gas discharge laser system fires at a pulse repetition rate of $x \geq 5000$ Hz;

each power amplification gas discharge laser fires and ½ x.

8. The apparatus of claim 4 further comprising:

the master oscillator gas discharge laser system fires at a pulse repetition rate of $x \geq 5000$ Hz;

each power amplification gas discharge laser fires and ½ x.

9. The apparatus of claim 5 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

10. The apparatus of claim 6 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

11. The apparatus of claim 7 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser

system to an input of a light utilization tool and providing at least beam pointing and direction control.

12. The apparatus of claim 8 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

13. A lithography tool comprising:

a very high repetition rate gas discharge laser system in a MOPA configuration comprising:

a master oscillator gas discharge layer system producing a beam of oscillator laser output light pulses at a very high pulse repetition rate;

at least two power amplification gas discharge laser systems receiving laser output light pulses from the master oscillator gas discharge laser system and each of the at least two power amplification gas discharge laser systems amplifying some of the received laser output light pulses at a pulse repetition that is a fraction of the very high pulse repetition rate, equal to one over the number of the at least two power amplification gas discharge laser systems, to form an amplified output laser light pulse beam at the very high pulse repetition rate.

14. The apparatus of claim 13 further comprising:

the at least two power amplification gas discharge laser systems is two power amplification gas discharge laser systems.

15. The apparatus of claim 13 further comprising:

the at least two power amplification gas discharge lasers systems are positioned in series with respect to the oscillator laser output light pulse beam.

16. The apparatus of claim 14 further comprising:

the at least two power amplification gas discharge lasers systems are positioned in series with respect to the oscillator laser output light pulse beam.

17. The apparatus of claim 15 further comprising:

the master oscillator gas discharge laser system fires at a pulse repetition rate of $x \geq 4000$ Hz;

each power amplification gas discharge laser fires and ½ x.

18. The apparatus of claim 16 further comprising:

the master oscillator gas discharge laser system fires at a pulse repetition rate of $x \geq 4000$ Hz;

each power amplification gas discharge laser fires and ½ x.

19. The apparatus of claim 15 further comprising:

the master oscillator gas discharge laser system fires at a pulse repetition rate of $x \geq 5000$ Hz;

each power amplification gas discharge laser fires and ½ x.

20. The apparatus of claim 16 further comprising:

the master oscillator gas discharge laser system fires at a pulse repetition rate of $x \geq 5000$ Hz;

each power amplification gas discharge laser fires and ½ x.

21. The apparatus of claim 15 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

22. The apparatus of claim16 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

23. The apparatus of claim 17 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

24. The apparatus of claim18 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

35. A laser produced plasma EUV light source comprising:

a very high repetition rate gas discharge laser system in a MOPA configuration comprising:

a master oscillator gas discharge layer system producing a beam of oscillator laser output light pulses at a very high pulse repetition rate;

at least two power amplification gas discharge laser systems receiving laser output light pulses from the master oscillator gas discharge laser system and each of the at least two power amplification gas discharge laser systems amplifying some of the received laser output light pulses at a pulse repetition that is a fraction of the very high pulse repetition rate, equal to one over the number of the at least two power amplification gas discharge laser systems, to form an amplified output laser light pulse beam at the very high pulse repetition rate.

36. The apparatus of claim 35 further comprising:

the at least two power amplification gas discharge laser systems is two power amplification gas discharge laser systems.

37. The apparatus of claim 35 further comprising:

the at least two power amplification gas discharge lasers systems are positioned in series with respect to the oscillator laser output light pulse beam.

38. The apparatus of claim 36 further comprising:

the at least two power amplification gas discharge lasers systems are positioned in series with respect to the oscillator laser output light pulse beam.

39. The apparatus of claim 37 further comprising:

the master oscillator gas discharge laser system fires at a pulse repetition rate of $x \geq 4000$ Hz;

each power amplification gas discharge laser fires and ½ x.

40. The apparatus of claim 38 further comprising:

the master oscillator gas discharge laser system fires at a pulse repetition rate of $x \geq 4000$ Hz;

each power amplification gas discharge laser fires and ½ x.

41. The apparatus of claim 37 further comprising:

the master oscillator gas discharge laser system fires at a pulse repetition rate of $x \geq 5000$ Hz;

each power amplification gas discharge laser fires and ½ x.

42. The apparatus of claim 38 further comprising:

the master oscillator gas discharge laser system fires at a pulse repetition rate of $x \geq 5000$ Hz;

each power amplification gas discharge laser fires and ½ x.

43. The apparatus of claim 39 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

44. The apparatus of claim40 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

45. The apparatus of claim 41 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

46. The apparatus of claim42 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

47. A very high repetition rate gas discharge laser system in a MOPO configuration comprising:

a first line narrowed gas discharge laser system producing a first laser output light pulse beam at a pulse repetition rate of $\geq$ 2000 Hz;

a second line narrowed gas discharge laser system producing a second laser output light pulse beam at a pulse repetition rate of $\geq$ 2000 Hz;

a beam combiner combining the first and second output light pulse beams into a combined laser output light pulse beam with a $\geq$ 4000 Hz pulse repetition rate.

48. The apparatus of claim 47 further comprising:

the first laser output light pulse bean is produced at a pulse repetition rate of $\geq$ 4000 Hz and the second laser output light pulse beam is produced at a rate of $\geq$ 4000.

49. The apparatus of claim 47 further comprising:

the first laser output light pulse bean is produced at a pulse repetition rate of $\geq$ 5000 Hz and the second laser output light pulse beam is produced at a rate of $\geq$ 5000.

50. The apparatus of claim 47 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

51. The apparatus of claim 48 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

52. The apparatus of claim 49 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

53. A lithography tool comprising:

a very high repetition rate gas discharge laser system in a MOPO configuration comprising:

a first line narrowed gas discharge laser system producing a first laser output light pulse beam at a pulse repetition rate of $\geq$ 2000 Hz;

a second line narrowed gas discharge laser system producing a second laser output light pulse beam at a pulse repetition rate of $\geq$ 2000 Hz;

a beam combiner combining the first and second output light pulse beams into a combined laser output light pulse beam with a $\geq$ 4000 Hz pulse repetition rate.

54. The apparatus of claim 53 further comprising:

the first laser output light pulse bean is produced at a pulse repetition rate of $\geq$ 4000 Hz and the second laser output light pulse beam is produced at a rate of $\geq$ 4000.

55. The apparatus of claim 53 further comprising:

the first laser output light pulse bean is produced at a pulse repetition rate of $\geq$ 5000 Hz and the second laser output light pulse beam is produced at a rate of $\geq$ 5000.

56. The apparatus of claim 54 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

57. The apparatus of claim 54 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser

system to an input of a light utilization tool and providing at least beam pointing and direction control.

58. The apparatus of claim 55 further comprising:
a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

59. A laser produced plasma EUV light source comprising:
a very high repetition rate gas discharge laser system in a MOPO configuration comprising:
a first line narrowed gas discharge laser system producing a first laser output light pulse beam at a pulse repetition rate of ≥ 2000 Hz;
a second line narrowed gas discharge laser system producing a second laser output light pulse beam at a pulse repetition rate of ≥ 2000 Hz;
a beam combiner combining the first and second output light pulse beams into a combined laser output light pulse beam with a ≥ 4000 Hz pulse repetition rate.

60. The apparatus of claim 59 further comprising:
the first laser output light pulse bean is produced at a pulse repetition rate of ≥ 4000 Hz and the second laser output light pulse beam is produced at a rate of ≥ 4000.

61. The apparatus of claim 59 further comprising:
the first laser output light pulse bean is produced at a pulse repetition rate of ≥ 5000 Hz and the second laser output light pulse beam is produced at a rate of ≥ 5000.

62. The apparatus of claim 59 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

63. The apparatus of claim 60 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

64. The apparatus of claim 61 further comprising:

a beam delivery unit connected to the laser light output of the power amplification laser system and directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

65. A very high repetition rate gas discharge laser system comprising:

a compression head comprising a compression head charge storage device being charged at x times per second;

a gas discharge chamber comprising at least two sets of paired gas discharge electrodes;

at least two magnetically saturable switches, respectively connected between the compression head charge storage device and one of the at least two sets of paired electrodes and comprising first and second opposite biasing windings having a first biasing current for the first biasing winding and a second biasing current for the second biasing winding and comprising a switching circuit to switch the biasing current from the first biasing current to the second biasing current such that only one of the at least two switches receives the first biasing current at a repetition rate equal to x divided by the number of the at least two sets of paired electrodes while the

remainder of the at least two magnetically saturable switches receives the second biasing current.

66. The apparatus of claim 65 further comprising:

the at least two sets of paired gas discharge electrodes is two sets of paired gas discharge electrodes;

the at least two magnetically saturable switches is two magnetically saturable switches; and

the switching circuit switches the first biasing current to one of the two magnetically saturable switches while switching the second biasing current to the second magnetically saturable switch.

67. The apparatus of claim 65 further comprising:

the at least two sets of paired gas discharge electrodes are positioned in parallel within the gas discharge chamber;

a gas circulation system circulating gas through the gas discharge chamber in a flow path that first encompasses a gap between the first set of paired electrodes and then encompasses a gap between the second set of paired electrodes;

a gas converter between the first and second set of paired gas discharge electrodes in the gas flow path.

68. The apparatus of claim 66 further comprising:

the at least two sets of paired gas discharge electrodes are positioned in parallel within the gas discharge chamber;

a gas circulation system circulating gas through the gas discharge chamber in a flow path that first encompasses a gap between the first set of paired electrodes and then encompasses a gap between the second set of paired electrodes;

a gas converter between the first and second set of paired gas discharge electrodes in the gas flow path.

69. The apparatus of claim 65 further comprising:

at least two line narrowing packages each optically interconnected to the a respective one of the at least two sets of paired gas discharge electrodes.

70. The apparatus of claim 66 further comprising:

at least two line narrowing packages each optically interconnected to the a respective one of the at least two sets of paired gas discharge electrodes.

71. The apparatus of claim 67 further comprising:

at least two line narrowing packages each optically interconnected to the a respective one of the at least two sets of paired gas discharge electrodes.

72. The apparatus of claim 68 further comprising:

at least two line narrowing packages each optically interconnected to the a respective one of the at least two sets of paired gas discharge electrodes.

73. The apparatus of claim 65 further comprising:

the at least two sets of paired gas discharge electrodes is two sets of paired gas discharge electrodes;

a single line narrowing package comprising:

a diffractive bandwidth selection optic;

a first optical path to the line narrowing package aligned with a first set of paired gas discharge electrodes comprising a first polarizing beam splitter that is essentially fully transmissive to laser light pulses of a first polarization and essentially fully reflective to laser light pulses of a second polarization;

first and second cavity windows aligned with the first optical path polarizing the laser output light pulses from the first set of paired electrodes in the first polarization direction;

first and second cavity windows aligned with the second set of paired electrodes polarizing the laser output light pulses from the second set of paired electrodes in the second polarization direction;

a beam reflector reflecting the laser output light pulses from the second set of paired electrodes into the first polarizing beam splitter;

a first polarizing mechanism between the first polarizing beam splitter and the diffractive bandwidth selection optic polarizing the output laser light pulses from the second set of paired electrodes to the first polarization when input into the diffractive bandwidth selection optic, and re-polarizing the output laser light pulses from the second set of paired electrodes to the second polarization direction upon return from the diffractive bandwidth selection optic;

a second polarizing beam splitter on the output of the laser output light pulses from the first set of paired electrodes that is essentially fully transmissive of laser output light pulses of the first polarization and essentially fully reflective of laser output light pulses of the second polarization;

a beam reflector reflecting the laser output light pulses from the second set of paired electrodes to the second polarizing beam splitter.

74. The apparatus of claim 73 further comprising:

a second polarizing mechanism polarizing the laser output light pulses from the second set of paired electrodes reflected in the second polarizing beam splitter to the first polarization direction.

75. The apparatus of claim 73 further comprising:

the first and/or the second polarizing mechanism is a dithered half wave plate that is dithered into and out of the optical path to the diffractive bandwidth selection optic depending on the presence or absence of light generated between the second set of paired electrodes.

76. The apparatus of claim 74 further comprising:

the first and/or the second polarizing mechanism is a dithered half wave plate that is dithered into and out of the optical path to the diffractive bandwidth selection optic depending on the presence or absence of light generated between the second set of paired electrodes.

77. The apparatus of claim 73 further comprising:

the first and/or second polarizing mechanism is an excited optical element modulated at the output laser light pulse pulse repetition rate.

78. The apparatus of claim 74 further comprising:

the first and/or second polarizing mechanism is an excited optical element modulated at the output laser light pulse pulse repetition rate.

79. The apparatus of claim 75 further comprising:

the first and/or second polarizing mechanism is an excited optical element modulated at the output laser light pulse pulse repetition rate.

80. The apparatus of claim 76 further comprising:

the first and/or second polarizing mechanism is an excited optical element modulated at the output laser light pulse pulse repetition rate.

81. A lithography to comprising:

a very high repetition rate gas discharge laser system comprising:

a compression head comprising a compression head charge storage device being charged at x times per second;

a gas discharge chamber comprising at least two sets of paired gas discharge electrodes;

at least two magnetically saturable switches, respectively connected between the compression head charge storage device and one of the at least two sets of paired electrodes and comprising first and second opposite biasing windings having a first biasing current for the first biasing winding and a second biasing current for the second biasing winding and comprising a switching circuit to switch the biasing current from the first biasing current to the second biasing current such that only one of the at least two switches receives the first biasing current at a repetition rate equal to x divided by the number of the at least two sets of paired electors while the

remainder of the at least two magnetically saturable switches receives the second biasing current.

82. The apparatus of claim 81 further comprising:

the at least two sets of paired gas discharge electrodes is two sets of paired gas discharge electrodes;

the at least two magnetically saturable switches is two magnetically saturable switches; and

the switching circuit switches the first biasing current to one of the two magnetically saturable switches while switching the second biasing current to the second magnetically saturable switch.

83. The apparatus of claim 81 further comprising:

the at least two sets of paired gas discharge electrodes are positioned in parallel within the gas discharge chamber;

a gas circulation system circulating gas through the gas discharge chamber in a flow path that first encompasses a gap between the first set of paired electrodes and then encompasses a gap between the second set of paired electrodes;

a gas converter between the first and second set of paired gas discharge electrodes in the gas flow path.

84. The apparatus of claim 82 further comprising:

the at least two sets of paired gas discharge electrodes are positioned in parallel within the gas discharge chamber;

a gas circulation system circulating gas through the gas discharge chamber in a flow path that first encompasses a gap between the first set of paired electrodes and then encompasses a gap between the second set of paired electrodes;

a gas converter between the first and second set of paired gas discharge electrodes in the gas flow path.

85. The apparatus of claim 81 further comprising:

at least two line narrowing packages each optically interconnected to the a respective one of the at least two sets of paired gas discharge electrodes.

86. The apparatus of claim 82 further comprising:

at least two line narrowing packages each optically interconnected to the a respective one of the at least two sets of paired gas discharge electrodes.

87. The apparatus of claim 83 further comprising:

at least two line narrowing packages each optically interconnected to the a respective one of the at least two sets of paired gas discharge electrodes.

88. The apparatus of claim 84 further comprising:

at least two line narrowing packages each optically interconnected to the a respective one of the at least two sets of paired gas discharge electrodes.

89. The apparatus of claim 81 further comprising:

the at least two sets of paired gas discharge electrodes is two sets of paired gas discharge electrodes;

a single line narrowing package comprising:

a diffractive bandwidth selection optic;

a first optical path to the line narrowing package aligned with a first set of paired gas discharge electrodes comprising a first polarizing beam splitter that is essentially fully transmissive to laser light pulses of a first polarization and essentially fully reflective to laser light pulses of a second polarization;

cavity window aligned with the first optical path polarizing the laser output light pulses from the first set of paired electrodes in the first polarization direction;

cavity windows aligned with the second set of paired electrodes polarizing the laser output light pulses from the second set of paired electrodes in the second polarization direction;

a beam reflector reflecting the laser output light pulses from the second set of paired electrodes into the first polarizing beam splitter;

a first polarizing mechanism between the first polarizing beam splitter and the diffractive bandwidth selection optic polarizing the output laser light pulses from the second set of paired electrodes to the first polarization when input into the diffractive bandwidth selection optic, and re-polarizing the output laser light pulses from the second set of paired electrodes to the second polarization direction upon return from the diffractive bandwidth selection optic;

a second polarizing beam splitter on the output of the laser output light pulses from the first set of paired electrodes that is essentially fully transmissive of laser output light pulses of the first polarization and essentially fully reflective of laser output light pulses of the second polarization;

a beam reflector reflecting the laser output light pulses from the second set of paired electrodes to the second polarizing beam splitter.

90. The apparatus of claim 89 further comprising:

a second polarizing mechanism polarizing the laser output light pulses from the second set of paired electrodes reflected in the second polarizing beam splitter to the first polarization direction.

91. The apparatus of claim 89 further comprising:

the first and/or the second polarizing mechanism is a dithered half wave plate that is dithered into and out of the optical path to the diffractive bandwidth selection optic depending on the presence or absence of light generated between the second set of paired electrodes.

92. The apparatus of claim 90 further comprising:

the first and/or the second polarizing mechanism is a dithered half wave plate that is dithered into and out of the optical path to the diffractive bandwidth selection optic depending on the presence or absence of light generated between the second set of paired electrodes.

93. The apparatus of claim 89 further comprising:

the first and/or second polarizing mechanism is an excited optical element modulated at the output laser light pulse pulse repetition rate.

94. The apparatus of claim 90 further comprising:

the first and/or second polarizing mechanism is an excited optical element modulated at the output laser light pulse pulse repetition rate.

95. The apparatus of claim 91 further comprising:

the first and/or second polarizing mechanism is an excited optical element modulated at the output laser light pulse pulse repetition rate.

96. The apparatus of claim 92 further comprising:

the first and/or second polarizing mechanism is an excited optical element modulated at the output laser light pulse pulse repetition rate.

97. A laser produced plasma EUV light source comprising:

a very high repetition rate gas discharge laser system comprising:

a compression head comprising a compression head charge storage device being charged at x times per second;

a gas discharge chamber comprising at least two sets of paired gas discharge electrodes;

at least two magnetically saturable switches, respectively connected between the compression head charge storage device and one of the at least two sets of paired electrodes and comprising first and second opposite biasing windings having a first biasing current for the first biasing winding and a second biasing current for the second biasing winding and comprising a switching circuit to switch the biasing current from the first biasing current to the second biasing current such that only one of the at least two switches receives the first biasing current at a repetition rate equal to x divided by the number of the at least two sets of paired electors while the remainder of the at least two magnetically saturable switches receives the second biasing current.

98. The apparatus of claim 97 further comprising:

the at least two sets of paired gas discharge electrodes is two sets of paired gas discharge electrodes;

the at least two magnetically saturable switches is two magnetically saturable switches; and

the switching circuit switches the first biasing current to one of the two magnetically saturable switches while switching the second biasing current to the second magnetically saturable switch.

99. The apparatus of claim 97 further comprising:

the at least two sets of paired gas discharge electrodes are positioned in parallel within the gas discharge chamber;

a gas circulation system circulating gas through the gas discharge chamber in a flow path that first encompasses a gap between the first set of paired electrodes and then encompasses a gap between the second set of paired electrodes;

a gas converter between the first and second set of paired gas discharge electrodes in the gas flow path.

100. The apparatus of claim 98 further comprising:

the at least two sets of paired gas discharge electrodes are positioned in parallel within the gas discharge chamber;

a gas circulation system circulating gas through the gas discharge chamber in a flow path that first encompasses a gap between the first set of paired electrodes and then encompasses a gap between the second set of paired electrodes;

a gas converter between the first and second set of paired gas discharge electrodes in the gas flow path.

101. The apparatus of claim 97 further comprising:

at least two line narrowing packages each optically interconnected to the a respective one of the at least two sets of paired gas discharge electrodes.

102. The apparatus of claim 98 further comprising:

at least two line narrowing packages each optically interconnected to the a respective one of the at least two sets of paired gas discharge electrodes.

103. The apparatus of claim 99 further comprising:

at least two line narrowing packages each optically interconnected to the a respective one of the at least two sets of paired gas discharge electrodes.

104. The apparatus of claim 100 further comprising:

at least two line narrowing packages each optically interconnected to the a respective one of the at least two sets of paired gas discharge electrodes.

105. The apparatus of claim 97 further comprising:

the at least two sets of paired gas discharge electrodes is two sets of paired gas discharge electrodes;

a single line narrowing package comprising:

a diffractive bandwidth selection optic;

a first optical path to the line narrowing package aligned with a first set of paired gas discharge electrodes comprising a first polarizing beam splitter that is essentially fully transmissive to laser light pulses of a first polarization and essentially fully reflective to laser light pulses of a second polarization;

cavity window aligned with the first optical path polarizing the laser output light pulses from the first set of paired electrodes in the first polarization direction;

cavity windows aligned with the second set of paired electrodes polarizing the laser output light pulses from the second set of paired electrodes in the second polarization direction;

a beam reflector reflecting the laser output light pulses from the second set of paired electrodes into the first polarizing beam splitter;

a first polarizing mechanism between the first polarizing beam splitter and the diffractive bandwidth selection optic polarizing the output laser light pulses from

the second set of paired electrodes to the first polarization when input into the diffractive bandwidth selection optic, and re-polarizing the output laser light pulses from the second set of paired electrodes to the second polarization direction upon return from the diffractive bandwidth selection optic;

a second polarizing beam splitter on the output of the laser output light pulses from the first set of paired electrodes that is essentially fully transmissive of laser output light pulses of the first polarization and essentially fully reflective of laser output light pulses of the second polarization;

a beam reflector reflecting the laser output light pulses from the second set of paired electrodes to the second polarizing beam splitter.

106. The apparatus of claim 105 further comprising:

a second polarizing mechanism polarizing the laser output light pulses from the second set of paired electrodes reflected in the second polarizing beam splitter to the first polarization direction.

107. The apparatus of claim 105 further comprising:

the first and/or the second polarizing mechanism is a dithered half wave plate that is dithered into and out of the optical path to the diffractive bandwidth selection optic depending on the presence or absence of light generated between the second set of paired electrodes.

108. The apparatus of claim 106 further comprising:

the first and/or the second polarizing mechanism is a dithered half wave plate that is dithered into and out of the optical path to the diffractive bandwidth selection optic depending on the presence or absence of light generated between the second set of paired electrodes.

109. The apparatus of claim 105 further comprising:

the first and/or second polarizing mechanism is an excited optical element modulated at the output laser light pulse pulse repetition rate.

110. The apparatus of claim 106 further comprising:

the first and/or second polarizing mechanism is an excited optical element modulated at the output laser light pulse pulse repetition rate.

111. The apparatus of claim 107 further comprising:

the first and/or second polarizing mechanism is an excited optical element modulated at the output laser light pulse pulse repetition rate.

112. The apparatus of claim 108 further comprising:

the first and/or second polarizing mechanism is an excited optical element modulated at the output laser light pulse pulse repetition rate.

113. A method of producing a very high repetition rate gas discharge laser system in a MOPA configuration comprising:

utilizing a master oscillator gas discharge layer system, producing a beam of oscillator laser output light pulses at a very high pulse repetition rate;

utilizing at least two power amplification gas discharge laser systems, receiving laser output light pulses from the master oscillator gas discharge laser system and, in each of the at least two power amplification gas discharge laser systems, amplifying some of the received laser output light pulses at a pulse repetition that is a fraction of the very high pulse repetition rate equal to one over the number of the at least two power amplification gas discharge laser systems to form an amplified output laser light pulse beam at the very high pulse repetition rate.

114. The method of claim 113 further comprising:

the at least two power amplification gas discharge laser systems comprises two power amplification gas discharge laser systems.

115. The method of claim 113 further comprising:

the at least two power amplification gas discharge lasers systems are positioned in series with respect to the oscillator laser output light pulse beam.

116. The method of claim 114 further comprising:

the at least two power amplification gas discharge lasers systems are positioned in series with respect to the oscillator laser output light pulse beam.

117. The method of claim 113 further comprising:

utilizing a beam delivery unit connected to the laser light output of the power amplification laser system, directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

118. The method of claim 114 further comprising:

utilizing a beam delivery unit connected to the laser light output of the power amplification laser system, directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

119. The method of claim 115 further comprising:

utilizing a beam delivery unit connected to the laser light output of the power amplification laser system, directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

120. The method of claim 116 further comprising:

utilizing a beam delivery unit connected to the laser light output of the power amplification laser system, directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

121. A method of performing integrated circuit lithography comprising:

utilizing a method for producing a very high repetition rate gas discharge laser system in a MOPA configuration comprising the steps of:

utilizing a master oscillator gas discharge layer system, producing a beam of oscillator laser output light pulses at a very high pulse repetition rate;

utilizing at least two power amplification gas discharge laser systems, receiving laser output light pulses from the master oscillator gas discharge laser system and, in each of the at least two power amplification gas discharge laser systems, amplifying some of the received laser output light pulses at a pulse repetition that is a fraction of the very high pulse repetition rate equal to one over the number of the at least two power amplification gas discharge laser systems to form an amplified output laser light pulse beam at the very high pulse repetition rate.

122. The method of claim 121 further comprising:

the at least two power amplification gas discharge laser systems comprises two power amplification gas discharge laser systems.

123. The method of claim 121 further comprising:

the at least two power amplification gas discharge lasers systems are positioned in series with respect to the oscillator laser output light pulse beam.

124. The method of claim 122 further comprising:

the at least two power amplification gas discharge lasers systems are positioned in series with respect to the oscillator laser output light pulse beam.

125. The method of claim 121 further comprising:

utilizing a beam delivery unit connected to the laser light output of the power amplification laser system, directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

126. The method of claim 122 further comprising:

utilizing a beam delivery unit connected to the laser light output of the power amplification laser system, directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

127. The method of claim 123 further comprising:

utilizing a beam delivery unit connected to the laser light output of the power amplification laser system, directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

128. The method of claim 124 further comprising:

utilizing a beam delivery unit connected to the laser light output of the power amplification laser system, directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

129. A method of producing EUV light utilizing a laser produced plasma comprising:

utilizing a very high repetition rate gas discharge laser system in a MOPA configuration comprising:

utilizing a master oscillator gas discharge layer system, producing a beam of oscillator laser output light pulses at a very high pulse repetition rate;

utilizing at least two power amplification gas discharge laser systems, receiving laser output light pulses from the master oscillator gas discharge laser system and, in each of the at least two power amplification gas discharge laser systems, amplifying some of the received laser output light pulses at a pulse repetition that is a fraction of the very high pulse repetition rate equal to one over the number of the at least two power amplification gas discharge laser systems to form an amplified output laser light pulse beam at the very high pulse repetition rate.

130. The method of claim 129 further comprising:

the at least two power amplification gas discharge laser systems comprises two power amplification gas discharge laser systems.

131. The method of claim 130 further comprising:

the at least two power amplification gas discharge lasers systems are positioned in series with respect to the oscillator laser output light pulse beam.

132. The apparatus of claim 131 further comprising:

the at least two power amplification gas discharge lasers systems are positioned in series with respect to the oscillator laser output light pulse beam.

133. The method of claim 129 further comprising:

utilizing a beam delivery unit connected to the laser light output of the power amplification laser system, directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

134. The method of claim 130 further comprising:

utilizing a beam delivery unit connected to the laser light output of the power amplification laser system, directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

135. The method of claim 131 further comprising:

utilizing a beam delivery unit connected to the laser light output of the power amplification laser system, directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

136. The method of claim 132 further comprising:

utilizing a beam delivery unit connected to the laser light output of the power amplification laser system, directing to output of the power amplification laser system to an input of a light utilization tool and providing at least beam pointing and direction control.

140. A method of producing very high repetition rate gas discharge laser pulses comprising:

utilizing a very high repetition rate gas discharge laser system in a MOPO configuration comprising:

a first line narrowed gas discharge laser system producing a first laser output light pulse beam at a pulse repetition rate of $\geq$ 2000 Hz;

a second line narrowed gas discharge laser system producing a second laser output light pulse beam at a pulse repetition rate of $\geq$ 2000 Hz;

a beam combiner combining the first and second output light pulse beams into a combined laser output light pulse beam with a $\geq$ 4000 Hz pulse repetition rate.

141. A method of performing integrated circuit lithography comprising:

utilizing a very high repetition rate gas discharge laser system in a MOPO configuration comprising:

a first line narrowed gas discharge laser system producing a first laser output light pulse beam at a pulse repetition rate of $\geq$ 2000 Hz;

a second line narrowed gas discharge laser system producing a second laser output light pulse beam at a pulse repetition rate of $\geq$ 2000 Hz;

a beam combiner combining the first and second output light pulse beams into a combined laser output light pulse beam with a $\geq$ 4000 Hz pulse repetition rate.

142. A method of producing a laser produced plasma EUV light source comprising:

utilizing a very high repetition rate gas discharge laser system in a MOPO configuration comprising:

a first line narrowed gas discharge laser system producing a first laser output light pulse beam at a pulse repetition rate of ≥ 2000 Hz;

a second line narrowed gas discharge laser system producing a second laser output light pulse beam at a pulse repetition rate of ≥ 2000 Hz;

a beam combiner combining the first and second output light pulse beams into a combined laser output light pulse beam with a ≥ 4000 Hz pulse repetition rate.

143. A method of producing very high repetition rate gas discharge laser pulses comprising:

utilizing a compression head comprising a compression head charge storage device being charged at x times per second;

utilizing a gas discharge chamber comprising at least two sets of paired gas discharge electrodes;

utilizing at least two magnetically saturable switches, respectively connected between the compression head charge storage device and one of the at least two sets of paired electrodes and comprising first and second opposite biasing windings having a first biasing current for the first biasing winding and a second biasing current for the second biasing winding and switching the biasing current from the first biasing current to the second biasing current such that only one of the at least two switches receives the first biasing current at a repetition rate equal to x divided by the number of the at least two sets of paired electrodes while the remainder of the at least two magnetically saturable switches receives the second biasing current.

144. The method of claim 143 further comprising:

the at least two sets of paired gas discharge electrodes is two sets of paired gas discharge electrodes;

the at least two magnetically saturable switches is two magnetically saturable switches; and

the switching step switches the first biasing current to one of the two magnetically saturable switches while switching the second biasing current to the second magnetically saturable switch.

145. The method of claim 143 further comprising:

the at least two sets of paired gas discharge electrodes is two sets of paired gas discharge electrodes;

utilizing a single line narrowing package comprising:

a diffractive bandwidth selection optic;

providing a first optical path to the line narrowing package aligned with a first set of paired gas discharge electrodes comprising a first polarizing beam splitter that is essentially fully transmissive to laser light pulses of a first polarization and essentially fully reflective to laser light pulses of a second polarization;

providing a cavity window aligned with the first optical path polarizing the laser output light pulses from the first set of paired electrodes in the first polarization direction;

providing a cavity windows aligned with the second set of paired electrodes polarizing the laser output light pulses from the second set of paired electrodes in the second polarization direction;

providing a beam reflector reflecting the laser output light pulses from the second set of paired electrodes into the first polarizing beam splitter;

utilizing a first polarizing mechanism between the first polarizing beam splitter and the diffractive bandwidth selection optic polarizing the output laser light pulses from the second set of paired electrodes to the first polarization when input into the diffractive bandwidth selection optic, and re-polarizing the output laser light pulses from the second set of paired electrodes to the second polarization direction upon return from the diffractive bandwidth selection optic;

providing a second polarizing beam splitter on the output of the laser output light pulses from the first set of paired electrodes that is essentially fully transmissive of laser output light pulses of the first polarization and essentially fully reflective of laser output light pulses of the second polarization;

providing a beam reflector reflecting the laser output light pulses from the second set of paired electrodes to the second polarizing beam splitter.

146. A method of performing integrated circuit lithography comprising

producing very high repetition rate gas discharge laser pulses comprising the steps of:

utilizing a compression head comprising a compression head charge storage device being charged at x times per second;

utilizing a gas discharge chamber comprising at least two sets of paired gas discharge electrodes;

utilizing at least two magnetically saturable switches, respectively connected between the compression head charge storage device and one of the at least two sets of paired electrodes and comprising first and second opposite biasing windings having a first biasing current for the first biasing winding and a second biasing current for the second biasing winding and switching the biasing current from the first biasing current to the second biasing current such that only one of the at least two switches receives the first biasing current at a repetition rate equal to x divided by the number of the at least two sets of paired electrodes while the remainder of the at least two magnetically saturable switches receives the second biasing current.

147. The method of claim 146 further comprising:

the at least two sets of paired gas discharge electrodes is two sets of paired gas discharge electrodes;

the at least two magnetically saturable switches is two magnetically saturable switches; and

the switching step switches the first biasing current to one of the two magnetically saturable switches while switching the second biasing current to the second magnetically saturable switch.

148. The method of apparatus of claim 147 further comprising:

the at least two sets of paired gas discharge electrodes is two sets of paired gas discharge electrodes;

utilizing a single line narrowing package comprising:

a diffractive bandwidth selection optic;

providing a first optical path to the line narrowing package aligned with a first set of paired gas discharge electrodes comprising a first polarizing beam splitter that is essentially fully transmissive to laser light pulses of a first polarization and essentially fully reflective to laser light pulses of a second polarization;

providing a cavity window aligned with the first optical path polarizing the laser output light pulses from the first set of paired electrodes in the first polarization direction;

providing a cavity windows aligned with the second set of paired electrodes polarizing the laser output light pulses from the second set of paired electrodes in the second polarization direction;

providing a beam reflector reflecting the laser output light pulses from the second set of paired electrodes into the first polarizing beam splitter;

utilizing a first polarizing mechanism between the first polarizing beam splitter and the diffractive bandwidth selection optic polarizing the output laser light pulses from the second set of paired electrodes to the first polarization when input into the diffractive bandwidth selection optic, and re-polarizing the output laser light pulses from the second set of paired electrodes to the second polarization direction upon return from the diffractive bandwidth selection optic;

providing a second polarizing beam splitter on the output of the laser output light pulses from the first set of paired electrodes that is essentially fully transmissive of laser output light pulses of the first polarization and essentially fully reflective of laser output light pulses of the second polarization;

providing a beam reflector reflecting the laser output light pulses from the second set of paired electrodes to the second polarizing beam splitter.

149. A method of producing EUV light utilizing a laser produced plasma comprising:

producing a very high repetition rate gas discharge laser pulses comprising the steps of:

utilizing a compression head comprising a compression head charge storage device being charged at x times per second;

utilizing a gas discharge chamber comprising at least two sets of paired gas discharge electrodes;

utilizing at least two magnetically saturable switches, respectively connected between the compression head charge storage device and one of the at least two sets of paired electrodes and comprising first and second opposite biasing windings having a first biasing current for the first biasing winding and a second biasing current for the second biasing winding and switching the biasing current from the first biasing current to the second biasing current such that only one of the at least two switches receives the first biasing current at a repetition rate equal to x divided by the number of the at least two sets of paired electrodes while the remainder of the at least two magnetically saturable switches receives the second biasing current.

150. The method of claim 149 further comprising:

the at least two sets of paired gas discharge electrodes is two sets of paired gas discharge electrodes;

the at least two magnetically saturable switches is two magnetically saturable switches; and

the switching step switches the first biasing current to one of the two magnetically saturable switches while switching the second biasing current to the second magnetically saturable switch.

151. The method of apparatus of claim 150 further comprising:

the at least two sets of paired gas discharge electrodes is two sets of paired gas discharge electrodes;

utilizing a single line narrowing package comprising:

a diffractive bandwidth selection optic;

providing a first optical path to the line narrowing package aligned with a first set of paired gas discharge electrodes comprising a first polarizing beam splitter that is essentially fully transmissive to laser light pulses of a first polarization and essentially fully reflective to laser light pulses of a second polarization;

providing a cavity window aligned with the first optical path polarizing the laser output light pulses from the first set of paired electrodes in the first polarization direction;

providing a cavity windows aligned with the second set of paired electrodes polarizing the laser output light pulses from the second set of paired electrodes in the second polarization direction;

providing a beam reflector reflecting the laser output light pulses from the second set of paired electrodes into the first polarizing beam splitter;

utilizing a first polarizing mechanism between the first polarizing beam splitter and the diffractive bandwidth selection optic polarizing the output laser light pulses from the second set of paired electrodes to the first polarization when input into the diffractive bandwidth selection optic, and re-polarizing the output laser light pulses from the second set of paired electrodes to the second polarization direction upon return from the diffractive bandwidth selection optic;

providing a second polarizing beam splitter on the output of the laser output light pulses from the first set of paired electrodes that is essentially fully transmissive of laser output light pulses of the first polarization and essentially fully reflective of laser output light pulses of the second polarization;

providing a beam reflector reflecting the laser output light pulses from the second set of paired electrodes to the second polarizing beam splitter.